With the Author's high regard



SURGICAL CONTRIBUTIONS

ON

Contraction and Hydrarthrosis

OF THE

KNEE JOINT,

BY

LOUIS BAUER, M.D., M.R.C.S. (ENG.);

LICENTIATE OF N. Y. STATE MED. SOC.; CORRESP. FELLOW OF THE LONDON MED. SOC.; MEMBER OF THE N. Y. PATHOLOGICAL SOC.; PROFESSOR AND SURGEON TO THE LONG ISLAND COLLEGE HOSPITAL, ETC.

1858

A CLINICAL LECTURE

ON

Contraction of the Knee-Joint,

WITH FALSE ANCHYLOSIS.

Delivered at the L. I. College Hospital, Brooklyn.

Gentlemen—The case of Mary Ryan, now before you, affords me an available opportunity for some clinical remarks on that class of infirmities to which her case belongs.

She is twenty-one years old, and, as you perceive, of good and robust constitutional health. Her menstruation has always been, and is still, in perfect order. At the age of four years she met with a fall upon her right knee, which subsequently became seriously affected. Timely and fair surgical aid proved of no avail, and thus she became afflicted with an angular deformity that rendered her right limb both useless and burdensome; she had, therefore, resorted to the use of crutches, which were her constant companions during the last seventeen years of her life.

You notice that her right knee-joint is bent in an angle of about 100 degrees; beyond that, she cannot extend the extremity, though she can easily flex it and reduce the angle to its normal size. Hence, this is not a case strictly to be termed anchylosis or articular immobility. The attempt to extend the deformed member meets with a strong resistance in the flexor muscles of the leg, which manifest a high degree of tension, more particularly the biceps. These muscles do not only not yield to extension, but, in extending, a most pain-

ful sensation is being produced in the joint, as the patient states it. It may also be noticed, that the external duplicature of the vagina femoris, inserting at the external condyle of the tibia, is shortened likewise, and participates, therefore, in the resistance. As the vagina femoris is not endowed with vital contractility, it is obvious that its shortening must be attributed to muscles, originating with that fascia; and in our case, we have to look upon the vastus externus as the active cause of this symptom.

The mobility of the joint and the considerable retraction of the muscles could lead us to diagnose this deformity as a mere contracture; yet this diagnosis would not cover the whole pathological ground, for you observe, in the first place, that the patella firmly adheres to the external condyle of the femur, and there are two cicatrices in front and laterally at the joint, one of which adheres firmly to the anterior surface of the internal femoral condyle. I am not prepared to admit that the joint has been perforated either by traumatic or spontaneous causes, for under such circumstances we should justly expect a total annihilation of the articular cavity.

The two scars originated, undoubtedly, with extra-capsular abscesses, and the conjecture seems to be justified, that the fall of our patient had primarily caused periostitis, and subsequently the extensive retraction of the flexor muscles.

The joint is somewhat deformed, owing collectively to the flexed position of the limb, the firm adhesion of the patella to the external condyle of the femur, and the rotation of the tibia with eversion of the foot. The whole leg is, moreover, atrophied, and to all appearance retarded in the development of its proper size. In fine, there is no where any soreness or pain within or about the joint, neither on moving nor touching, and the whole feature of the case manifests that this disease has many years ago terminated its course.

Like cases are as numerous as the inflammatory lesions of the knee-joint, and the history of our patient may be considered as a fair prototype for many of them. The knee-joint, exposed as it is, renders it but too often subject to injuries; the continued use for locomotion, the pressure of a considerable superincumbent weight upon the articular surfaces, will inevitably and prejudicially co-operate with the traumatic cause; and in fine, surgical art has heretofore proved to be a very negative friend in these cases.

Thus it so happens, that almost all these lesions take their own course, either despite or without surgical treatment, until the extrem-

ity becomes the object for amputation, or gradual improvement sets in, and the inflammatory process subsides spontaneously, leaving, however, the limb more or less deformed, and locomotion impeded.

Surgeons conversant in and practically experienced on the subject of articular diseases and deformities, will bear me evidence, that almost all inflammatory affections of some intensity, pertaining either to a joint itself, or its surrounding periosteum, give rise to muscular retractions, and, consequently, to prejudicial position and deformity. I am perfectly certain of the fact, that the before-named lesions, in all their stages, coexist with such muscular retractions; they almost begin with them, and decidedly terminate but rarely without them, differing only in the degree of deformity. I do not mean to maintain that muscular retractions, consequent upon joint diseases, are the exclusive causes of deformity connected with them; but they are decidedly the most frequent ones. I am well aware, that effusion within the articular cavity, surrounded by a firm, unyielding, morbidly thickened and solidified articular capsule, will, by necessity, influence the relative position of the concerned extremity. The effusion will, under such circumstances, act like a wedge driven anteriorly between the articular surfaces of the knee-joint, and cause an angular deformity of the limb, which will continue until the liquid is absorbed or is suffered to escape through an opening in the capsule. It is evident, also, that under that condition the limb may be flexed, but cannot be perfectly extended. The accumulation of inflammatory effusion within the hip-joint affects the position of the femur most singularly, and results in a deformity, which is recognized as the second degree of hip disease, the limb being apparently elongated, slightly flexed, abducted, the toes everted, the pelvis lowered, and the affected joint immovable, which is, by the by, the very position in which we throw the limb by artificially injecting the cavity of hip-joint. If the surrounding capsule of a joint, however, is of ordinary texture, and the accumulation of the liquid within the joint ensues but gradually, as, for instance, in hydrarthrosis of the knee, we notice no deformity of the limb.

However numerous the causes may be that affect the relative position of the knee-joint, it is evident that muscular retraction is the most pre-eminent one.

In perusing the numerous text and hand-books of surgery, nay, even in monographs on articular diseases, as, for instance, in the valuable work of Prof. Bonnet, of Lyons, there is a conspicuous deficiency as to the physiological character of those muscular retractions that should

be filled by accurate research. Most authors coincide in the deformity pertaining to joint diseases being the result of volition on the part of the patient. A mere superficial inquiry will, however, show the entire fallacy of such an opinion, in as far at least as the muscular retractions are concerned.

1st. If it be true, as some authors say, that violent pain induces patients to relieve themselves by assuming an easier position, the argument looses its strength in all those numerous chronic cases in which the pain is comparatively trifling and when the disease has subsided.

2d. If volition is a sufficient cause of angular deformities of the limb, volition would and should be a sufficient remedy for its removal.

3d. If volition is the source of the deformity under consideration, the deformity should be removable during sleep, and under chloroform anæthesis, when volition is dormant or suspended, which, however, is not the case.

4th. If volition is the sole cause of muscular retraction, there could not be that amount of resistance with which we meet when attempting to extend the limb, which occasionally, even with the aid of chloroform inhalations, is insurmountable.

5th. The limb of some patients being raised without support, most usually trembles and shakes; and in one case, namely, in that of the patient Schindler, which I shall relate more extensively hereafter, chlonic spasms were observed, which alternately flexed and extended the limb most rapidly, and to the greatest horror and agony of the patient. This symptom did not subside until the flexor muscles had been divided.

This muscular retraction appertains by no means to the knee-joint exclusively; on the contrary, it occurs also in connection with the diseases of other joints, and more particularly as an inseparable companion of hip-joint disease. Hence it seems to be a symptom essential and pathognomonic to articular diseases in general. Obviously these muscular retractions are caused by reflex action, within the sphere of the excito-motoric nerves, and, though originating from the articular disease, they acquire a certain pathological independence, extending their existence far beyond the termination of actual disease; nay, they may even reflect upon the disease itself, in aggravating and reproducing the same malady from which they originally rose. In order to illustrate this observation, I take the liberty of relating two cases, that will fully bear them out.

A young lady from Hobart, Delaware County, State of New York, came under my care, for both angular deformity and immobility of her right knee-joint, besides superficial caries of the tibia of small extent. Her troubles had commenced with periostitis of tibia; ulceration, and subsequently superficial caries, had ensued, causing numerous fistulous openings along the anterior angle of that bone, all of which, except one, had closed, when I saw the patient first. The joint seemed to have been secondarily affected, and its disease had never passed beyond a plastic arthro-meniugitis, giving rise, however, to adhesions between the correspouding articular surfaces, the patella being as usually connected with the external condyle of the femur. The flexors had to be divided on account of their retractiou, and under the iufluence of chloroform the articular adhesions were by main force broken up, the diseased portions of the bones also removed by gouge and chisel, and the extremity secured and bandaged up in a straight iron splint. Several weeks had elapsed siuce the operation. There had been no reaction whatsoever, and the patient had already been about with the help of crutches, moderately bearing the weight of her body on the affected leg, when suddenly, and without auy perceptible cause, the joint once more became excessively painful, swolleu, red, and tender to the touch. Repeated applicatiou of leeches, constaut use of ice, external and internal administration of mercurials and opium, failed to give the slightest relief. The patient was deprived of rest and appetite, and complained loudly of the violence of her pains, which were not only subjective, but also occasioued by pressure. It was mostly concentrated about the internal condyles of both tibia aud femur, assuming all phenomena of returned periostitis.

Quite accidently it was discovered that the flexion of the foot increased considerably the pain, and in following up the course of the symptom, a retraction of the gastrocnemius muscle was uoticed. Having failed in relieving the patient by the antiphlogistic apparatus, the division of the Achilles tendon was decided upon and promptly performed. From that very moment all inflammatory symptoms rapidly disappeared, and within a week the patient resumed locomotion.

The other instance is of a still more striking character. It relates to a little boy, seven years of age, from Montgomery, Ala., afflicted with a spurious anchylosis of left knee-joint and retraction of the corresponding flexor muscles, causing angular deformity of the extremity. The little fellow was brought to me on the 2d of October last. On that same day, when under the influence of chloroform, I divided both

the biceps and the lower end of the duplicature of the vagina femoris, the latter particularly with a view of amending a slight grade of genu varum, coexisting; the adhesions of the joint were then broken up, the extremity extended without difficulty and properly splinted. Although simi-membranosus and semi-tendinosus, etc., were slightly tense, yet they yielded readily to the extending power, on which ground their intended division was relinquished.

In the evening following, patient was feverish and restless, crying vehemently from pain in his joint, though he had intermissions; the joint was somewhat intumesced and tender to the touch. I promptly instituted antiphlogistic treatment.

October the 3d, patient had passed a wretched night, had slept scarcely any, all symptoms were on the increase. On removing bandage and splint, the leg slightly bent, and this seemed to relieve him. The joint was otherwise very tender and hot; there was moderate effusion within its cavity.

During the succeeding five days the inflammation assumed an alarming character, and the little patient suffered fearfully and incessantly. The most rigid antiphlogosis gave not the slightest benefit; the rupture of the joint and the ultima ratio chirurgorum seemed not to be far distant. Over and over again the joint had been subjected, with the aid of chloroform, to careful examination, and not without perseverance a slight tension of some of the flexor muscles was made out, having remained undivided; their tension was, however, so significant as hardly to justify division.

But in order to secure every chance to the patient, I nevertheless performed the operation, and strange to say, from that very moment the inflammation subsided as rapidly as it had made its appearance, and since then I never had any occasion to contend with it.

Another symptom accompanying retractions of muscles is, the emaciation of the whole member. The character of this symptom has not as yet been sufficiently comprehended. Almost all surgeons attribute it to the want of exercise, but this interpretation is far from being true. During the treatment of fractures of the lower extremities, in which the latter are forced into perfect rest, and where the attenuation is increased by pressing bandages, we do not observe a waste equal to that in joint diseases.

Even in perfect paraplegia of a year's duration, the emaciation does not come up to the mark of that collateral to joint diseases. It is not a rare occurrence, that the circumference of a thigh is reduced to 3-5ths

within one month by hip disease. It can not be said that the muscles loose their bulk by being converted into tendinous structure, in consequence of morbid retraction, for this metamorphosis requires a far longer space of time. Moreover, this process would be limited to the retracted muscles alone. Nor can it be asserted, that the waste of a member is progressively increased by suppuration of a joint, for not all joints suppurate when affected, and yet the attenuation is the same. Hence, we must look out for another cause, and as such, we may accept the *morbid reflex innervation.* Indeed, we have many analogous proofs that tend to corroborate my views. We find, for instance, a remarkable atrophy of face and neck in wry-neck, irrespective of the sterno-cleidomastoid muscle itself. We strike upon a similar analogy in club-hand and club-foot, and in one instance, where pes equinus had been acquired by an Irishman, forty years of age, through a stab in his back, and a subsequent reflex action upon his gastrocnemius muscle, which contracted and raised the heel three inches, the leg atrophied considerably within a very short time after the accident. On the other hand, in dividing the contracted muscles, the extremity increases in both bulk, muscular strength and temperature. All those facts tend to prove the correctness of my views, and the practicability to increase the physical strength of a member by myotomy of its retracted muscles.

In the common routine practice it is taken as granted, that almost all articular affections originate in constitutional troubles, more especially in scrofulous diathesis. In fact, scrofulosis is premised everywhere, where a tenable cause can not easily be taken hold off. That term is applied with a looseness that is self-sufficient to doubt its correctness. The profession of every country have their pass-words, which are resorted to when the physician is embarrassed by questions which his knowledge is unable to answer. And the great poet Goethe is correct in remarking, that words are but too often substituted for thoughts and knowledge. For an inquisitive mind, however, and in science such words necessarily loose their charm, more especially when facts contrast their application. Close observation and cautious deduction, from what should be considered an ample field of inquiry, have convinced me that traumatic causes lie at the foundation of a large majority of these cases. The same appertains to the so-called hip-joint disease. It is true, that the disease does not always immediately follow the injury, sometimes months intervene between cause and effect; this is, after all, more apparent than real. For instance, a

child sustains a fall upon the upper extremity of the tibia, the fall is sufficiently violent to produce a hæmorrhage within the cancelated tissue, the blood gradually degenerates, and a long time after the fall the degenerated blood causes osteomyelitis, pain, swelling and softening of the articular extremity; and not before this period the disease is noticed, and therefore not considered a disease at all, though the pathological process goes on steadily.

We have seen limbs amputated, in which, on minute examination, a degenerated blood-clot seemed to have been the only cause and starting point of subsequent serious trouble. And without any doubt in my mind, I am free to say, that the origin of a good number of bone abscesses is of this very order. Another instance is, the periosteum is contused and lacerated; in others a sprain of the ligaments and the synovial membrane may be the starting point. I believe, however, that most cases grow out of injuries of bone and periosteum.

After a patient, however blooming, strong and robust his health may have been at the commencement, has suffered for weeks and months close confinement, the tortures of Tantalus, has been deprived for a long period of appetite and rest, and has been perhaps subject to a considerable waste of bodily materials by suppuration, we, as a matter of course, should not be surprised to find such patient pale, anæmic, transparent and emaciated, or leucæmic and bloated. It would be decidedly improper to call such a state scrofulous, but it should be at least understood that this strangely so-called scrofulosis is not the cause, but mostly the effect. In order to test this question fairly and conclusively, a number of such cases have been treated with liberal diet and local applications only, and the results have exceeded my most sanguine expectations. I do not mean to assume, that plastic or tonic treatment is entirely dispensable; yet iron, bark, quinine, etc., do not strictly come under the head of anti-scrofulous remedies. But even these remedies may be dispensed with, as long as appetite and digestion of the patient are sufficiently strong to assimilate steaks and chops, for I could not persuade myself that a few grains of iron or quinine could possibly effect the same benefit as some ounces of beef or mutton.

In the preceding remarks I have tried to show, that muscular retractions are pathognomonic phenomena of almost all inflammatory diseases of the knee-joint, that they form almost their primitive symptoms, though hitherto utterly disregarded. It is self-evident that, in incipient cases of inflammation of the knee-joint, the prevention of

muscular retraction is a paramount object of the treatment. In fact, prevention and treatment of muscular retractions in acute cases is almost identical with the treatment of the disease itself. The therapeutical maxims heretofore "en vogue" among surgeons, have wrought most disastrous results. The whole antiphlogistic apparatus, strengthened with constitutional treatment against the promised scrofulous diathesis, and supported by the derivatory method, have dissatisfied both surgeons and patients, and joint affections, especially those of the hip and knee-joints, were consequently looked upon as most odious and dreaded objects for medical attendance. In the ordinary practice of almost every surgeon, apparently mild cases have been observed, which, despite of all active treatment, steadily advanced from bad to worse, extending over a period of years. Frequently, amputation was the only remedy to relieve the sufferings. But the inevitable consequence was deformity, if the knife had spared the limb.

This being the case, we may justly pause, in order to inquire into the causes, negative or positive, which have led to these discouraging results; in doing so, we may arrive at some practical suggestions, that may eventually turn the scale in our favor.

Gentlemen, you will recollect the second case mentioned at a previous occasion. The patient was young, robust, and as healthy as any child of his age living. The inflammation that attacked the joint, after brisement forcé had been performed, was of a pure hypersthenic character, without any constitutional tint whatsoever. If there was any case qualified for the antiphlogistic treatment, it was his, and for seven days I pursued it to its full latitude. The result you know already. And I have no hesitation in surmising, that the case could not have done worse without treatment than it did with mine. What right have we to expect better results in protracted and complicated cases?

A whole series of similar instances might be superadded, yet one already quoted will suffice to argue the point in view, namely, the inefficiency of antiphlogistic treatment in cases like these. The same remark will apply to derivation. I can honestly assure you, that it met a fair trial at my hands, but the benefit derived therefrom was at the best questionable, and in most instances decidedly bad. It is therefore but natural that I should have entirely discarded it in the treatment of joint diseases, and, unaided by practical results, neither high-sounding names nor any professional authority could make us believe in its usefulness and practicability.

Within twenty years, prominent members of our profession, particularly Sir Benj. Brodie, have, in the treatment of joint diseases, inculcated the maxim of keeping inflamed joints at perfect rest. Rational and simple as this advice unquestionably is, it has never been executed to its full extent. Most surgeons deem it sufficient to lay their patients up, and the affected member upon a pillow; yet this plan permits prejudicial movements, and the gradual retraction of the flexor muscles. Prof. Bonnet, of Lyons, is still more strict than Sir Benjamin. He asserts, that the proper position of the limb affected with a joint disease is the most indispensable requisite of successful treatment, and I can most emphatically corroborate and affirm his views. The happy results which have followed my own practical application of those principles, have been due to their faithful execution, and the firm confidence in their truth. Since their adoption many of my anxieties regarding joint affections have subsided, and I can therefore warmly and conscientiously commend them to your consideration.

The first rule in the treatment of these cases is, to secure both rest and position to the affected extremity; under no circumstance can this be dispensed with. A straight splint made of sheet-iron, and conforming with the shape and size of the member designed for, is all you want for their accomplishment. You fill this splint with cotton, and fasten it on the posterior surface of the extremity, which it should cover from the tuber ischii to the heel. If the joint is much swollen and sensitive, it may be advisable to apply a sufficient number of leeches, so as to relieve the capillary engorgement; and subsequently, after having filled the popliteal cavity with a cushion, to surround the joint with well and tightly applied adhesive straps, so as to exercise a gentle pressure upon the inflamed parts, and to favor the absorption of effused liquids. If this proceeding should be too painful for the inflamed and tender tissues, and more especially if there are already slight muscular retractions, opposing the straight position of the limb, chloroform inhalations to perfect anæsthesis will aid you in overcoming all difficulties. It is very seldom that the patients experience any pain after that proceeding; most usually they are forthwith relieved, and the improvements go on steadily to convalescence. Nor does it seem to make any difference whether one or the other tissue of the joint is involved, as in practice the discrimination of diseases in the different structures are of less importance than in purely scientific points.

During the past eight weeks three patients were received at this Institution, namely:

Peter Morlan, 5 years of age, suffering from chronic arthro-meningitis of one knee-joiut; James Kearnan, 4 years of age, from periostitis about the knee-joint; and Andrew Mitchel, 4 years of age, from chronic ostitis of the articular portion of the tibia. In these three cases the joint and locomotion were painful, the affected extremities hardly touched the ground on walking. They had, moreover, in common a contracture of the biceps muscles, producing angular deformities of greater or lesser extent. The three cases were treated alike. After dividing the biceps, the limbs were reduced to straight posture, surrounded by gently-pressing plaster bandage, and finally secured within an iron splint, such as you have seen here. Within a fortnight these children were so much improved as to walk with facility and without pain. The joints were reduced in size and temperature, and painless to touch and motion. It needs hardly to be mentioned, that the patients did not receive a grain of medicine, nor any other external application, than those already named. The following case, however, is by far more calculated to interest your attention, and to imbue you with confidence in this mode of treatment.

Ludwig Schindler, 25 years of age, a German by nationality, a miller by trade, and a man of strong and powerful frame, and above the middle size, when on his voyage to his new home in the year 1853, sustained a heavy fall and struck thereby his right knee-joint. Though it soon after became painful, he disregarded it entirely, and deferred all treatment until his arrival at the harbor of New York.

He consulted in succession various surgeons; he received the same advice, to keep his leg at rest, to leech and blister his joint, and call again. As time went on, without bringing him any relief, and as the disease seemed rather on the increase, whereas his financial resources were rapidly decreasing, he applied for and received admission into Ward's Island Hospital. There he remained about six months, and though it is said that that institution is exceedingly successful in the treatment of all species of joint diseases, it decidedly did not succeed in subduing the malady of Schindler. He left, and made repeated attempts to procure relief from private surgeons. Failing in this, and his disease growing steadily worse, he once more entered the institution of the Commissioners of Emigration. He left a second time, to re-enter a third, with full determination of having his limb amputated, which was approved of by the attending surgeon. The latter, how-

ever, meeting at that time with an accident to his hand, and being, therefore, disabled from attending to his operative duties at Ward's Island Hospital, the operation had to be postponed, which ultimately saved his extremity. A friend persuaded the patient to come to Brooklyn, where he should accommodate him at his residence, and, if the amputation should be necessary, it might be done in the circle of his friends.

Application being made at this Institution, I saw the patient at 16 Union Street, in company with other medical practitioners of this city. I found the patient much reduced; he manifested high fever and excruciating, though periodical pains in his right knee, which, he stated, had prevented his sleeping for longer than 5 minutes at a time for several weeks; his agony was so great as to extort cries sufficiently loud to be heard in adjacent buildings. His knee-joint presented all the features of the so-called tumor albus. The circumference of the joint was twice as large as the other, and the tumor was firm and hard, hiding of course all contours of the joint. Under the skin large veins encircled the tumor in every direction. No fluctuation could be felt anywhere, and I became convinced that the joint contained but insignificant effusion, patella loose and movable, as was also the joint. Although the tumor was extremely painful when touched, yet the greater and most violent pain was coincidently produced with periodical spasms, which threw the whole extremity into violent tremor, and bent the leg on the thigh to an angle of about 145 degrees. These spastic reflex phenomena returned at periods from 3 to 5 minutes, lasting but 15 seconds, and allowing a painless intermission of some minutes. Never have I witnessed before nor since such distinctly expressed reflex actions in cases of joint or bone disease, as in the present instance, and they strikingly confirmed the views already expressed with reference to reflex actions, as the true cause of muscular retractions.

I furthermore noticed a signal distension of the articular extremity of the femur, which in fact had twice the circumference of its original normal size; the bone was excessively painful on pressure, and it seemed as if it was softened also.

My diagnosis was osteomyelitis, with bone abscess in the course of formation, located in the inferior extremity of the femur; inflammation of the joint and consecutive enlargement, complicated with a high degree of reflected spasm in all, but particularly in the flexor muscles of the leg.

It being rather late when I saw the patient, I contented myself to fasten the leg in a straight splint, and to make four pretty deep incisions anteriorly into the tumor, and to order a large opiate. On my visit next morning, I learned that he had enjoyed a few hours' rest, the first time after weeks of incessant sufferings. Although this looked encouraging, the patient, nevertheless, was perfectly hopeless as to the benefits likely to be derived from any mode of treatment. He demanded the amputation of the leg as a favor—nay, he insisted upon it peremptorily. Indeed, self-confidence in the efficacy of my treatment forsook me when I looked at the affected parts and considered the condition of the patient. Hence, I earnestly wavered in my mind whether the amputation was not in every respect preferable to a slow course of treatment, that might eventually fail and call for amputation at last. However, I decided that the preservation of a limb, especially in a laboring man, was worth a trial after all; but in order to be permitted to do so, the patient insisted upon the following terms: That if within 5 days his pain should not have abated, and his condition somewhat ameliorated, the amputation should be performed without further delay.

The curative plan proposed was as follows:

1. Division of the flexor muscles of the leg, in order to remove a serious and most painful complication.

2. To bandage up the whole member, surround the knee-joint and the adjoining portion of the femur with adhesive straps, and to imbed the limb in a straight splint.

If this proceeding sufficed to soothe the pain, it was my intention, at a later period, to trephine the lower extremity of the femur, with a view to remove its morbid contents. The first part of the treatment was performed forthwith, and the patient subsequently kept under opium narcosis. The following days passed without a return of the periodical pains pertaining to the spastic contractions of the muscles, which had ceased entirely, and the treatment was therefore carried on for about four months. At the end of two months, the tumefaction had diminished to a third of its original size, the soreness of the affected parts had passed away, the patient's weight was increased 25 pounds, and from that time he resumed locomotion with the aid of a supporting instrument and two crutches. As the improvement suffered no farther interruption, I dispensed with the third part of the curative plan, and discharged the patient. During the year succeeding his discharge, he occasionally presented himself at this institution,

supported only by a cane. He still wore the instrument, and I have since learned that he is engaged in working the sewing machine. I may yet have an opportunity to show you the patient at a future occasion, and then you may hear repeated, from his own lips, the history of this case, and judge for yourselves of the results attained by this treatment.

The termination of inflammatory affections of the knee-joint differs widely, according to the structures in which the disease has settled, or to the extent it has proceeded. Acute inflammation of the synovial membrane most usually ends in fibrous adhesions, connecting both articular surfaces and the patella to the external condyle of the femur; the limb is more or less flexed, and the tibia rotated on its longitudinal axis, with everted position of the foot. This pathological condition of a knee-joint is comprised under the term of spurious anchylosis, which, under all circumstances, permits a certain degree of motion.

If, however, both synovial membrane and articular cartilages have been involved and partially ulcerated, we find a different state of things, namely, the partial formation of fibrous tissue in the joint, along with insular bony union. Such a case is illustrated by No. 969 in the Hunterian Museum of the R. C. S., England.

Or synovial membrane, cartilage, and bone have been collectively involved in the morbid process, and then we find a total bony union of both articular surfaces so complete, that on longitudinally dividing the bones we may fail in detecting even the original articular marks. Such specimens are, however, comparatively rare. If the periosteum is exclusively the seat of disease, it will frequently give rise to the formation of osteophytes, interlacing the joint externally to its cavity.

From the limited mobility, we may infer that an anchylosis is a so-called spurious or fibrous one. It does not, however, follow that an immovable joint is truly anchylosed by new-formed bone, and we have, therefore, to admit a third or mixed form of anchylosis.

The discrimination of the various forms of anchylosis is of the utmost practical importance, deciding, as it does, the operative proceeding. It is not, however, always *à priori*, possible, and without an attempt at forcible breaking up *(brisement forcé)* an anchylosed joint and deformed member, to discriminate the different forms of ancholosis, as the following instance will exemplify:

Dr. Moses, one of the surgeons of the Jew's Hospital of New York, courteously invited me, some two years ago, to witness Dr. Buck's

operation in a case of presumed true anchylosis of a knee-joint. That gentleman stated that two eminent surgeons had examined the case thoroughly, and that the diagnosis was, therefore, unquestionable. I suggested it as possible, that the immobility of the joint might be caused by a very slight bony union, and perhaps even by some small osteophytes, extraneous to the joint. This induced Dr. Moses to attempt brisement forcé previous to Dr. Buck's operation, which attempt proved perfectly successful, though I convinced myself in that case that there was not the slightest degree of mobility.

We need not dwell upon the treatment of true anchylosis as known by Drs. Barton and Buck's operations, for they are universally known, and I have not any new feature or improvement of those well-calculated operative proceedings to suggest. All it is proposed, is to illustrate the treatment of spurious or mixed anchylosis of the knee-joint, as connected with the case of Mary Ryan.

The treatment of spurious and mixed anchylosis with contractures of limb, is comparatively of recent date, though attempts to remove these impediments of locomotion may be as old as surgical knowledge. We already find mechanical apparatus constructed by Fabricius Hildanus, Hans Gersdorf, Ryff and others, with a view of gradually stretching the anchylosed and contracted extremity. Yet the experience of those gentlemen seemed to have been of a very discouraging nature, and we must, therefore, not be surprised to see such proceedings discountenanced by contemporary surgeons. Previous to the discovery of subcutaneous tenotomy, by Dr. Strohmeyer, the treatment of such cases was hardly entertained, and attended mostly with discouraging results; but since then, great improvements have been effected, much suffering allayed, and deformities removed that were odious to both social and business life.

With Strohmeyer originated the method of gradual extension. He did not conceive any other obstacle in removing such deformities than the shortened muscles, which he divided; he became, however, soon aware that the muscles constitute but one portion of the resisting difficulties; his curative results were, therefore, by no means as satisfactory as he had anticipated, and it became evident that his method was deficient. A few years after the introduction of subcutaneous tenotomy, a young physician of Paris, Dr. Louvrier, had the boldness to perform the brisement forcé of false anchylosis of knee-joints, with and without previous tenotomy of the flexor muscles. The novelty and boldness of his proceedings produced a great sensation, and the

Royal Academy of Medicine appointed a committee to investigate the results of Dr. Louvrier's method. Their report severely condemned it, on account of its violence, danger and uncertainty. It does not seem that Louvrier's method had acquired any ground, either in France or in England; whereas, in Germany, Dieffenbach eagerly took hold of that operation and performed it in a considerable number of cases. But, on the whole, he attained but meagre results, while some of his patients, after fearful sufferings, lost their lives. Being at that time a student of Prof. Dieffenbach, I had a fair opportunity of observing how disheartened he felt with reference to this operation. The greatest change of the curative results in the treatment of these cases has been wrought by the introduction of chloroform. It not only removes all horror and pain from the operative proceeding itself, but its beneficial effects chiefly consist in preventing that much dreaded inflammatory reaction in the joint after operation. With chloroform, the operation upon anchylosis spuria has become a comparative surgical trifle for both surgeon and patient, and it is now being performed all over the civilized world. Surgeons differ still, as to the choice of the method, some preferring the slow process of gradual extension, whilst others recommend the more expeditious one of brisement forcé, of Louvrier. They are also at variance whether to divide the tendons of the flexor muscles, or to ignore them. The preference of one or the other has led to the establishment of different maxims. Thus, for instance, Prof. Langenbeck, of Berlin, (de contractura genu et anchylosi genu,) relates several cases in which he performed with perfect success the brisement forcé, without any division of tendons, whilst Lorinser, of Vienna, with the help of chloroform and a partial brisement, resorts to Strohmeyer's method. It is of no small interest to compare the arguments of those gentlemen with each other, and with facts derived from their and other modes of treatment.

The different anatomical difficulties with which we may have to contend singly or collectively in the treatment of mixed and spurious anchylosis of the knee-joint, complicated with angular deformity, are—

1st. Osteophytes.

2nd. Scattered points of bony union between the articular surfaces.

3d. Pseudo-fibrous structure, connecting both opposite articular surfaces.

4th. Rigidity of articular ligaments, caused by organized inflammatory exudation around their tissue.

5th. Dense fibrous tissue, forming cicatrices around the joint, and rendering the soft parts firm and unyielding.

6th. Retractions of the flexor muscles, to which occasionally may be added a tense condition of the external duplicature of the vagina femoris, through medium of the vastus externus muscle.

7th. Alteration of the articular surfaces.

It is self-evident that first and second numbers cannot be reached by gradual extension, but demand forcible measures. With reference to the third form, it should be borne in mind that fibrous tissue, the result of plastic inflammatory exudation, is extremely dense, firm, and unyielding, possessing but a very limited amount of elasticity. It follows, therefore, conclusively, that the resistance of such tissue within the articular cavity cannot be overcome by gradual extension, but must be torn from its connections by sudden and forcible stretching. The dense fibrous tissue of scars is a less serious obstacle to gradual extension. The elongation thus obtained, however, is more to be ascribed to the gradual relaxation of the healthy tissues surrounding scars than to any change effected in the scars themselves. Cicatrices in the neighborhood of joints, and consequent upon joint diseases, extend mostly from the surface to the deeper parts, at right or acute angles; such as run across from one side of the joint to the other, are extremely rare, and if present, may materially impede the progress of treatment.

In the present state of our knowledge, it is considered doubtful whether ligamentous structures are ever subject to inflammation; if not, their elastic properties cannot be changed by any such process occurring in their neighborhood.

Nevertheless ligaments may become distorted by new formations of fibrous tissue upon them; yet they return to their proper shape and position when the obstructions are removed by extension.

In reference to the retractions of muscles, I must call your attention to the facts elicited by pathological anatomy. It has been clearly proven by minute research, that muscular structures, which have been kept retracted for a length of time by morbid innervation, usually become converted into fibrous tissue, with more or less perfect loss of their vital contractility. This pathological feature entirely governs the operative proceedings, for if retracted muscles have undergone this change, they cannot yield sufficiently under the influence of chloroform and gradual extension, but firmly resist; and if the surgeon should succeed in straightening the limb whilst the patient is under the influ-

ence of chloroform, the retraction will return at a subsequent period. This at least is my experience in a conclusive number of cases. Moreover, I have at a prior occasion submitted to your attention three cases, which must have convinced you that the retractions of muscles bear a different pathological estimate, as hitherto premised.

Those surgeons who are in favor of not dividing retracted muscles, maintain, that they preserve thus their power and utility for the purpose of locomotion. This argument would be well enough if it could be sustained by practical issue. On this very ground I have to repudiate it. It is self-evident, and requires no further comment, that a muscle, having undergone fibrous degeneration, is more or less devoid of its muscular contractility and is therefore capable of no relaxation. The small amount of elastic extensibility of such tissue is, in most cases, insufficient for the purpose in view. In the case of Mary Ryan, this morbid contraction has been in existence for 17 years consecutively, and it can therefore be scarcely assumed that the structure of the flexor muscles in the affected extremity should have preserved its normal condition.

Premising, however, for the sake of argument, that the muscular structure was still existent, and therefore in a condition to resume its function at the moment that the limb had been extended, it is exceedingly doubtful, in the first place, whether it will yield the amount of length required, or whether the yield under the influence of chloroform will continue; or, in fine, whether reactions in the joint will not be favored by putting those muscles on the stretch. The advantages to be derived from non-division of retracted muscles are, therefore, doubtful and questionable, whilst it may be the cause of great inconvenience, pain and failure, and even more dangerous consequences. On the other hand, I am pretty much satisfied that tenotomy does not materially disqualify divided muscle for its functional performance.

From physiological considerations, therefore, and collected facts, derived from practical experience, I have naturally come to the conclusion to divide, as a rule, the tendons of all muscles that resist the intended extension of any angularly deformed extremity; and since the adoption of this plan, I have decidedly been more successful in the treatment of such and similar cases. The earlier this is done, the better are the effects for the whole leg and its usefulness; the longer a limb is permitted to remain in that distorted condition, the more it will suffer from atrophy; and you perceive, therefore, in Mary Ryan's case that not only the circumference, but also the length of her affected

extremity is deficient, and we shall be obliged to make up for the latter deficiency by a very thick sole, in order to equalize its length with that of the other limb.

Adopting the plan adverted to in Mary Ryan's case, you will have ample opportunity to witness the various acts of the proceeding.

1st. I shall divide the flexor muscles, including also the tendinous string of the vagina femoris. A narrow but strong blade is the most available form for the tenotome; whereas it is indifferent whether its cutting edge is straight or slightly curved. Most surgeons divide the tendons from within to without; I prefer the reverse, at least with reference to the popliteal space and the division of the sterno-clavicular tendon of the sterno-cleidomastoid muscle, in order to render the operation both thorough and safe; you have thus perfect control over your knife; on inserting it upon the external surface of the tendon, you notice most distinctly the moment when division is completed. In order to render this operation perfectly harmless, you have to watch that no air should enter the wound; secondly, not to draw the knife too rapidly, but rather to press it through the tendon; and in fine, in dividing, the extension should be made as great as possible, in order to lift up the tendons from subjacent important parts. After carefully closing the wounds, you proceed to:

2nd. The forcible extension, or as it is called by a French term, brisement forcé. The object of this act is to break up bony and fibrous impediments, and to bring the limb at once in a straight position. To accomplish this object, more or less physical strength is necessary. Louvrier, Manget, Bouchet, Delpech, Bonnet, and other French surgeons, have constructed mechanical apparatus; but the hand of the surgeon, well aided by competent assistants, is all that is needed for the performance of that operation. In preferring the hand to odious-looking instruments, the surgeon can control far better the amount of power that is required, and guard more against accidents.

As this portion of the proceedings is the most painful, the chloroform anæsthesis should be complete when performed, with the view of protecting the patient both against pain and the much dreaded local reaction. The latter effects of chloroform cannot be questioned, since they have been realized by many surgeons in hundreds of cases.

Preparatory to the forcible extension, Palasciano, and after him Bonnet, have suggested the division of the triceps muscle above the knee-joint, in order to facilitate the separation of the patella from the external condyle of the femur. This, however, is in most instances

entirely superfluous, as the patella most usually becomes movable by the act of forcible stretching. The division of the triceps muscle should, therefore, be reserved for such cases in which the patella does either not yield at all, or in which it occupies a position (fossa intercondyloidea,) that interferes directly with the consummation of the operations.

The patient should lie on his back whilst the forcible extension is being performed, an assistant fixing his pelvis, another taking hold of the foot, whilst the surgeon places his hands upon the anchylosed knee. Whilst the assistants simultaneously extend and counter-extend, the knee is being pressed down, which under ordinary circumstances is easily done. If there is any suspicion of bony obstacles, the extension should be performed with a sudden jerk; sometimes it requires a considerable amount of physical strength; at others a few pounds of extension and pressure will succeed in straightening the limb.

Occasionally you may straighten the limb to an angle of about 130 degrees, and beyond that you may meet with resistance. This may or may not be overcome by continual extension; it should, however, be borne in mind, that this resistance is sometimes due to undivided and retracted muscles, and if so, they should be subsequently cut.

Before bandaging up the affected limb, repeated flexion, extension and rotations of the leg should be made, in order to remove the last traces of pseudo-fibrous tissue.

In some instances, more especially in such where the retractions of muscles have not been completely removed by the knife, or where collateral obstacles remain, being cicatrices or ligamentous, etc., the forcible extension may occasionally produce a posterior subluxation of the tibia on the femur, with the effects of pressing upon the popliteal nerves and vessels, and thus paralyzing the extremity downwards. The adjoining diagram, (fig. 1,) illustrates this relative position.

In the moment you notice it, (which you may by the malformation of the knee, and the patient complaining about numbness in the leg and toes,) you should at once proceed to improve the position, either by removing the restrictions, or by bending the leg over a large but firm roller, which serves as the fulcrum for the lever of the leg, and mostly produces the desired effect. The rest of the operation consists in applying an expulsive bandage upon the leg, in firmly and equally surrounding the knee-joint with adhesive straps, and in placing the operated member into a straight and well-padded splint, (fig. 2,) in which it is fastened by circular tours of a roller.

This is the whole of the operation, which sometimes, however, requires to be modified.

Fig. 1.



Fig. 2.

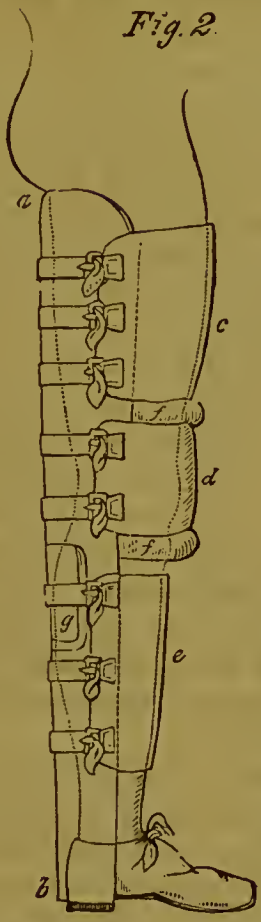
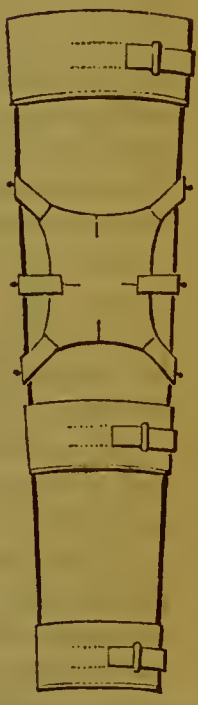


Fig. 3.



The patient, thus fixed, is taken to bed and kept under opiates the ensuing 24 hours, which is done with a view of preventing both pain and reaction. The latter has occurred in my practice but a few times, and it was invariably due to the neglect of dividing all retracted muscles; the subsequent division of which proves, therefore, a better antiphlogistic remedy than leeches, ice, and mercurials collectively. If no pain indicates any trouble of the patient, I do not remove the bandage before the third day, and only then with a view of ascertaining the condition of the wounds. The extremity is again dressed in the same manner as before mentioned, and the splint replaced.

In a fortnight the supporting instrument (fig. 3,) is applied, and the patient permitted to walk; should the deficient length of the extremity render it necessary, a higher soled boot is resorted to, to make

up for the deficiency. A month or two after the operation, a flannel bandage may be used for the knee-joint in the place of adhesive straps. Most patients are satisfied with a straight and stiff limb, but if they should desire it, and the condition of their joints permit it, gradual flexions and extensions may be instituted, and so long continued until a sufficient degree of articular mobility is re-established. If after the operation some fibrous adhesions of the joint should have been reformed, it may be advisible to break them up under the influence of chloroform, and to disturb their reformation by constant motion. This proceeding is, however, advisable only if their is no inflammatory trouble to contend with; otherwise it should be deferred to such a period in which it could be safely done.

The motions of the joint may be made either by the hand, or by the apparatus before you, (fig. 4.)

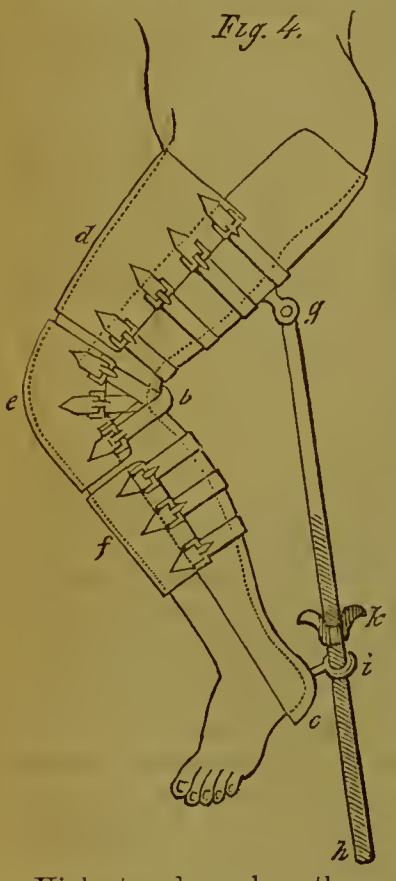


Fig. 4.

In this more or less modified manner, according to the individual character of the case, I have, up to this day, successfully treated 124 cases. Among them were some of long duration, of great obstinacy and distortion. Most of them had been under charge of competent surgeons, and some had been attended by the most prominent men of our profession. This statement is made without any intention of passing censure upon my medical colleagues, nor for self-arrogation; it is made for the purpose only, to bring in statistical high relief the soundness and greater practical efficiency of a treatment that is not as yet sufficiently known among us, and that commends itself to the consideration of every surgeon.

Violent and rough as the operation of brisement forcé may appear to the uninitiated, it is nevertheless almost entirely free from those accidents of which many works on surgery loudly speak. The number of surgeons engaged in the performance of this operation, and the

number of cases operated upon, is decidedly large enough to solve that point, yet I have hitherto in vain perused the surgical records for accidents of the stated nature. Arteries or veins, and nerves, may be ruptured, particularly if they have been rendered brittle by atheromatous deposits. But as those operations are chiefly performed upon juvenile patients, in which atheromatous degenerations are hardly known, it sufficiently accounts for the absence of such accidents.

Among the patients under my care, I had but one disastrous result, owing, I believe, as much to the shock caused by the chloroform upon the system of the patient, as by the operation itself. The case relates to a negro of Demopolis, Ala., who had been afflicted with a contracture of his flexor muscles, and a limited degree of spurious anchylosis of his knee-joint, for more than thirty years. Drs. Asche and Ruffin, in whose presence the operation was performed, will bear evidence, that the case in question belonged to the most obstinate ones a surgeon may encounter.*

* Since the delivery of this lecture, among other successfully treated cases, I have met with a serious accident of so rare and unique a nature, that it should not be passed over without being related. For an unsuccessful case may convey by far more instruction than 20 successful ones. On this very ground, I consider myself in duty bound to publish that case, in order to benefit and guard those of my medical brethren who may follow me in the performance of the operation.

Patrick Feenay was received into the Long Island College Hospital, and placed under my care on the 4th of January last. He was a youth above middle size, of feeble and anæmic appearance, and rather slender, though otherwise healthy. Being employed for some years at a manufactory in treading a wheel, he had overstrained his right limb, was consequently attacked with an inflammatory affection of the knee-joint, which subsequently gave rise to angular deformity, with impeded mobility. The extremity was bent in an angle of 105 degrees, and the motion of the knee-joint limited within an angle of 30 degrees. In this position the posterior surface of the condyles of the femur rested upon the tibia, with which they were connected by fibrous neoplasms. The patella was retained within the intercondyloid space and was slightly movable. All flexors were retracted and tense.

The patient desired to be relieved from his deformity, and the operation was consequently performed upon him in the presence of the medical and surgical staff of the hospital, joined by some medical gentlemen connected with other public institutions. The patient was put under the full influence of chloroform, the flexor muscles divided, and the limb first bent and subsequently extended; the amount of physical strength required in this instance was, to all present and myself, surprisingly small; the extremity was then bandaged in the ordinary way and the patient removed to his bed.

For three days he was doing fairly. No reaction ensued in the joint, nor did

I may be permitted to adduce to my leeture the history of another case, which is of the highest surgical interest and importance, at the same time linked together with the subject under consideration.

the patient complain of any inconvenienee. When on the 3d day the dressings were removed, some slonghing in the immediate neighborhood of the wonnds was notieed, bnt aseribed to a moderatc ecchymosis and the bad eonstitntion of the patient. During the snbsequent four days the slonghing inereased, embraeing almost the whole integnments of the popliteal space. A line of demarcation and granulations were forming on the 8th day, but dennded bone was also notieed in the depth. Owing to the considerable drainage npon the system of the patient, and most probably eonseqnent upon putrid absorption, the patient, as might have been expeeted, suffered severely. The safety of the patient depended on the speedy amputation of the limb, npon which my eolleagnes, and another medical gentleman of great experience and surgieal sagaeity, agreed. The operation was performed in the middle of the thigh, and so qniekly that bnt abont two onnces of blood were lost.

Though the patient seemed to rally after the operation, yet he never got free from an asthenic typhoid fever, that terminated his life on the twentieth day after the ampntation, the wound being then almost closed. The adjoining diagram (fig. 5,) shows the pathological condition in whieh the interested bones and the joint were found. Bnt one side of the adhesions, namely, between the external condyles, had yielded, whilst the fibrons strnctnre between the external eondyles of the joint had firmly resisted the forcible extension; the patella was fonnd quite loose. The apophysis had beeome diseonneeted from the diaphysis of the femnr; periostenm having been destroyed posteriorly upwards to the middle of the thigh bone, and in the remaining portion attempts were being made at the formation of new bone. The denuded portions of the bone are porous and rongh from the maceration in pns.



Fig. 5.

A large proportion of those patients I have treated, in cases like the present one, were children, in whom bony union could not have taken place between the apophysis and diaphysis of their respeetive bones; and though I had in somc instances employed three times, and even more physieal strength, to extend the limb, yet neither I, nor to my knowledge any other snrgeon, has as yet met with a similar aeeident.

The key to the understanding of the said aeeident may be simply fonnd in retarded development and puberty of the patient in general, and protraeted solidification of the synchondrosis between the respeetive portions of his boues especially, whilst on the other hand the neoplasms between the articnlar surfaces of the knee-joint were of a very firm and strong organization. The aeeident, with other words, is therefore due to physieal disproportions between the union of the thigh bone on one side, and the pseudo-union of the joint on the other.

A young gentleman, resident of Brooklyn, 21 years of age, of anæmic and feeble appearance, limped on two crutches into my office on the 21st day of October, 1856, and stated, that at the age of 11 years he suffered from a traumatic injury upon his left knee-joint, followed by a moderate inflammatory affection, extending over a period of three years. The affection, however, being not very painful and causing no deformity, did not seriously interfere with his locomotion. Repeated falls upon the said joint, and a blow with a hammer, increased the disease of the joint to such a degree as to render him incapable of walking about, unless supported by crutches.

On examination, the affected extremity presented the following appearance: knee-joint immovable; patella adhering to external condyle of femur; knee-joint bending inwardly (knock-kneed,) and forwardly, with rotation of the leg and eversion of the toes; the external circumference of the joint somewhat swollen and excessively painful; the flexor muscles extremely tense and shortened, their tendons raised from the bone. In front of and superiorly to the knee-joint there was an even and oval distinctly circumscribed tumor, 9 inches in length and about 4 in breadth; its lower extremity terminating about the superior insertion of the capsular ligament of the knee-joint; its upper one ending about the middle of the thigh. The tumor was evidently located below the vagina femoris, and was to the feel of very hard structure; the triceps femoris was displaced and located on the left side of the tumor.

The diagnosis of the tumor was to me a difficult task, presenting, as it did, some symptoms of chondroid or fibrous tumor, and in other respects that of an encysted liquid, being even and circumscribed. An abscess it could not be, for the subfascial collections of pus assume, by necessity, a diffused form, though the firmness of the tumor would not have excluded that diagnosis, as it is well known that the unyielding and firm texture of the fascia constantly obscures fluctuation, and thus endowing every collection of liquid with the character of a hard tu-

It cannot be denied, that this accident might have been evaded by postponing the operation, and by putting the constitution in proper condition; and the experience once derived from this case, will exercise, for all future, a sufficient influence of my surgical proceedings in like cases.

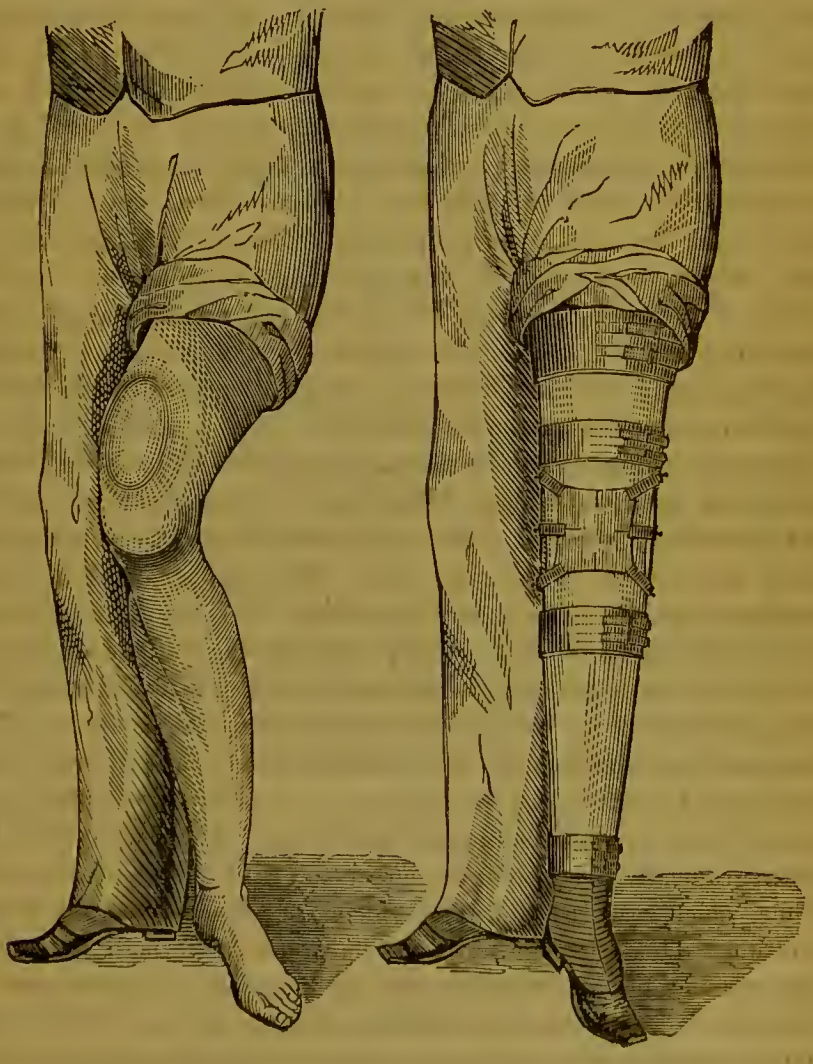
Yet in defence of my action, I may here state, that it is impossible for any surgeon to ascertain, à priori, whether synchondrosis is still extant between the shaft of a bone and its apophysis; whether there is any disproportion in the physical resistance of the former or the pseudo-fibrous structure of an anchylosed joint. Every surgeon has therefore to trust to chances, more or less.

mor. In feeling over the whole surface of the tumor, I discovered indistinct fluctuation at a very small spot, not larger but what it could be covered with a finger's point, perhaps the aperture of a passing vein; and to render my diagnosis of *hydrops bursæ subrectalis* still more definite, I introduced an exploring trocar, and fourteen ounces of a yellowish pellucid semi-gelatinous and soapy fluid were abstracted, presenting no organized particles under the microscope—containing, however, large quantities of albumen and some alkalines. This fact elucidated at once the whole pathological complication of the malady, which I conceived to be as follows: the original injury produced most probably bursitis of a low character, which could exist for years without materially incommoding the patient; but repeated accidents increased the effusion to such an extent, that the bursa became so much distended as to assume the physical character of a roll, over which the triceps muscle was acting prejudicially to the joint. Each contraction of said muscle physically strengthened by the bursa, (as a roll of course,) threw the knee-joint inwards, (knock-knee,) strained the internal ligaments, thus giving rise to inflammatory action in the joint, which terminated its mobility by fibrous adhesion. As the weight of the body traversed the joint in a diagonal direction, overburdening chiefly the internal ligaments of the joint, the latter remaining sore, and in order to obviate pain, the patient had to suspend the limb and to resort to the use of crutches.

Since the diagnosis had been clearly made out, the treatment could meet with no extraordinary difficulties; I divided the flexor muscles and performed brisement forcé, the patient being at the same time under the full effects of chloroform. The extremity was then well bandaged and placed in a straight splint. No reaction whatsoever followed the operation, but on the contrary, the patient felt greatly relieved by the reformation of his limb, and the pain had almost entirely subsided from the internal circumference of the joint. This treatment was continued for some months, and a gentle pressure exercised upon the bursa, yet by this time a re-collection of fluid to the extent of a few ounces had again taken place. In order to relieve the patient radically, I injected the bursal sac with a diluted tincture of iodine, which gave rise to a most violent bursitis, terminating in suppuration. The latter continued for many months through some fistulous openings, but gradually ceased. At the present time, the previous bursal sac is firmly closed up, but the triceps muscle had lost its bulk and contractility, and therefore no attempts have been made at re-estab-

lishing mobility. The extremity, however, is perfectly straight, and can be used without any pain or inconvenience whatsoever. The patient still wears a supporting instrument, besides using a cane. The case has been seen by some of our most prominent surgeons, and engaged their greatest interest. If the patient relates it correctly, his case was pronounced "white swelling," and amputation deemed advisable; so that the result of my treatment may be looked upon as a satisfactory piece of conservative surgery.

The adjoining diagrams represent a general outline of the previous and present form of the limb.



ON

Hydrarthrosis of the Knee-Joint.

A PAPER

Read before the Brooklyn Medico-Chirurgical Society.

Gentlemen—The pathological nature of hydrarthrosis is as yet an unsettled question. Some authors still adhere to the discrimination of an acute and chronic form; whereas others contend, on the basis of pathological anatomy, that if inflammation of the synovial membrane is at all at the basis of this malady, that it is decidedly and exclusively the lowest degree imaginable.

The term hydrarthrosis implies, verbally, water in a joint, meaning of course serum of indifferent chemical constitution, and with the least possible trace of either organization or organizable substance.

Dupuytren qualifies the serum obtained from a delinquent, immediately after execution, as transparent, pinkish, semi-gelatinous, of insipid taste, peculiar smell, and a spec. grav. of 1.05. Bonnet describes it as being pellucid, lemon-colored, and thin, coagulating when exposed to either heat or nitric acid; from his observation, he felt inclined to identify the serum in hydrarthrosis with that of the blood; ascites, hydrocele, &c.

Thirteen cases of hydrarthrosis, upon which I performed the operation of punction 17 times, have furnished me ample opportunities to study the physical and chemical properties of the morbid secretion in question, and the following is a summary of my observations:

1. In all instances the serum was transparent.

2. When pure, it presented a straw color, but being incidentally mixed with blood corpuscles, it assumed a pinkish hue.

3. Its consistence was semi-gelatinous, varying, however, according to the quantity; larger accumulations of serum were more fluid than smaller ones, which occasionally presented the appearance of colloid fluid.

4. Under the microscope, the serum was found to be amorphous; not even epithelial cells could be noticed. Besides accidentally intermixed blood corpuscles, I noticed a moderate number of fat globules.

5. Its chemical reaction was invariably strong alkaline, which was even evinced by a slippery and soapy feel.

6. Being boiled or subjected to nitric acid, the entire fluid most usually coagulated, so that the vessel could be turned over without its contents flowing out.

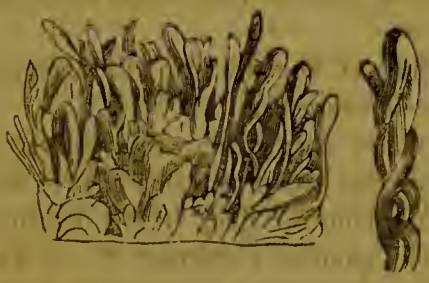
7. Spec. grav. differed from 1.02 to 1.12, according to the degree of concentration or consistence.

Frequent efforts have been made to investigate the pathological condition of the synovial sac in hydrarthron, yet with very little success or satisfaction. Thus Sir Benj. Brodie describes a case, in which he found the whole synovial membrane of the knee-joint darkened and highly vascular; the smaller vessels being distended, as in violent conjunctivitis. On the anterior superior portion of the joint he noticed deposits of plastic lymph, (fibrin.) The articular cartilage presented a tendency of detaching itself from the condyles of the femur. He gives us, however, no information as to the serum, which in all probability contained epithelial cells, inflammatory globules, and fibrin abundantly. From the description, it must be inferred that Sir Benjamin's patient suffered from nothing less than acute and plastic inflammation of the synovial membrane, which would have in due time brought on fibrous adhesion or suppuration.

Blaudin's case is no less doubtful. He saw numerous flakes suspended in the serum, and the inflammation was particularly intense at the large duplicature of the knee-joint! Dupuytren records a fair instance of hydrarthron. He mentions the large distention of the synovial capsule beyond its natural limits, and 4 inches in front of the femur. The lining membrane was found to be intumesced and red; there were small vascular eminences of different extent and size, from which a similar liquid could be pressed. Bonnet's case bore the following appearance: Synovial membrane opaque, slightly thickened and fibrous; inner surface red, and numerous bundles of vessels travers-

ing it, particnlarly near and about the patella; the covering of the ligamenta cruciata was found to be intact. On those points, where the capsule was engorged, the surface was covered with pseudo-membranes of new growth, and on others adhesion had been forming. It is not difficult to perceive that Bonnet had fallen into the same error with Sir Benjamin, confounding active arthromeningitis with hydrarthron.

The best anatomico-pathological research on this malady, the profession owes to Rokitansky and Johannes Müller. According to these pathologists, the synovial membrane presents the appearance of velvet, and under the microscope numerous villi or tubes are to be seen, interweaving dentrically with each other, (lipoma arborescens. Joh. Müller.) Those villi receive ordinary and elastic fibres into



their organization, and contain fat, either free or encapsuled; sometimes hyaline and cartilaginous cells, and in rare instances even osseous elements. Their size sometimes exceeds an inch. If pressed, the same liquid oozes out of their surface as contained in the joint.

Analyzing the symptoms of hydrarthron clinically, we find that,

1. The disease commonly commences in such an obscure way, that the patient scarcely knows of its existence until it has obtained a certain degree of development, and the distention of the joint has become noticeable.

2. Irrespective of the distention of the joint by its serous contents, there is no swelling, tumefaction, discoloration or increased temperature of the joint thus affected, or the adjacent soft parts.

3. There is no pain of any account, neither on motion nor on pressure.

4. The accumulation of articular serum is progressing so gradually, that the capsule gains time in yielding to the pressure from within, and so adapt its dimensions to the quantity of fluid present. Thus Dupuytren, others, and myself have observed cases in which the synovial sac had extended upwards before the femur, some inches beyond

and above its insertion. And this adaptability of the synovial membrane to the liquid within its cavity is the reason why ruptures of the synovial sac, pain, and deformities are so rare companions of hydarthron. It is, however, self-evident that all the motions of thus afflicted joints are to be made slowly, in order to give the serum time and chance to move into another space when the form of the articular cavity is to be altered by the motion. When the knee is being flexed, for instance, the articular fluid can readily find room between the parting articular surfaces; when being extended, it has to escape into the anterior space of the capsule.

5. However long hydrarthron may exist, I have found neither any adhesion of the joint, nor any ulceration or denuding of articular cartilage.

6. Nor have I ever observed that this malady causes any constitutional trouble either in its beginning or its progress.

Critical analysis of those facts, elicited by pathological and chemical observation of hydrarthrosis, will necessarily lead to different inferences as hitherto entertained by some eminent surgeons. From the chemico-organic constitution of the serous fluid generated in hydrarthrosis, it is evident that it can have no connection whatsoever with acute inflammation. Except the alkalines abundantly contained in that fluid, it bears the most perfect similarity with the serum in ascites, caused by mere obstruction of the abdominal venous circulation. There is indeed not one single element to be found that is pathognomonic of inflammation. We arrive at the same conclusion in analyzing the clinical character of hydrarthron. The anatomico-pathological changes of the synovial membrane are, however, of so peculiar a nature as to admit of a different interpretation. On one hand the varicous distention of the capillaries remind involuntarily of obstructions in the circulation, whilst the organic elements of the villiform tissue render an inflammatory process feasible, at least in as far as the fibrous elements are concerned. However, these indications are exceedingly faint, and as long as other fibrous disorganizations occur without inflammation, we may justly hesitate to admit it here in the absence of other corroborative circumstances. Without intention to advance a new hypothesis, I may, however, submit that a paralytic condition of the vaso-motor (Henle) nerves may be at the foundation of this morbid process. Indeed both the contusion of the joint as remote cause, and the anatomical condition of the synovial membrane in hydrarthrosis, speak in favor of this suggestion. At any rate, the dis-

cussion of this subject will have rendered obvious the fallacy of acute hydrarthrosis. Against the supposition of hydrarthrosis, on the ground of chronic inflammation of the synovial membrane, I should take no exception, since the pathological discrimination between a low grade of inflammation and deteriorated nutrition, caused by the paralysis of vaso-motor nerves, is an object of subtle difficulty.

Another error prevails among some surgeons as to the remote causes of hydrarthron, represented to be mostly of constitutional or rheumatic character. The observations afforded by thirteen cases justify my differing from such suppositions. In twelve cases out of that number the malady could be distinctly traced to traumatic causes, and occurred in patients from between seven to twenty-six years of age, who without any exception possessed all the attributes of good constitutional health. But in one case, concerning an Irish laborer of about forty years of age, and of suspected irregular and intemperate habits, the constitution of the patient seemed to be debilitated, and hence the cause of the disease obscured and dubious.

Among the series of cases there was Mr. —— ——, a butcher of New York, twenty years of age when the disease commenced. He was then, and is still of robust constitution and great physical strength. On lifting a quarter of beef he suffered undue torsion of his left knee-joint, which was followed by swelling and inconvenience in walking. No other cause could be made out in this instance, and the disease had been of two years' duration when the patient placed himself under my care. Another case relates to a little boy eleven years old, strong and healthy looking, who had passed his life on a farm on the shores of Cayuga Lake under very easy circumstances. He too had contracted his difficulty by a fall upon his knee. The remaining ten cases are almost of the same description, so much so, that the two already related may be accepted as prototypes of the rest.

From the causes and the clinical character of hydrarthrosis, it follows conclusively that the disease is mainly, and perhaps exclusively, an idiopathic one, and that it only in a remote way becomes connected with constitutional complications.

Diagnostic discrimination of hydrarthrosis of the knee-joint meets with less difficulty the more considerable the quantity of accumulated serum within the knee-joints. It presents a fluctuating swelling that is distinctly limited by the contours of the joint, and more especially by the insertion and shape of the synovial sac itself. Where the patella and ligaments do not flatten the swelling, the latter is even

and convex, more especially lateral to the ligamentum patellæ, the patella itself, and above it. The greatest distention of the synovial membrane, however, is in the direction of the superior cul-de-sac, where the fluctuation is mostly clear and unmistakable. Sometimes the synovial cavity communicates with the bursa below the tendon of the quadriceps, and this communication of course modifies the shape of the swelling. The integuments are of natural appearance, and no pain is evinced on motion or pressure. The fluctuation may be clearly ascertained, if the affected extremity is fully extended, when the liquid occupies the anterior portion of the joint. The hands may then be placed transversely above and below the patella, and alternately a gentle pressure be made. Or while a pressure is being made simultaneously by both hands in that position, and the patella pressed upon, the presence of liquids in the joint may be discriminated by the resistance the patella finds in approaching the bones. Or graduated compresses are fastened upon the joint below and laterally to the patella, by which means the whole liquid is driven into the cul-de-sac of the synovial membrane, and the exploring needle being introduced will show the presence of liquid in the joint, though this would be hardly required for the purpose of diagnosis.

From previous remarks, it follows clearly that the prognosis of this disease is by no means as hopeless or dubious as generally represented. As long as the term hydrarthrosis is not properly defined, and as long as the latter comprises a series of heterogeneous diseases, the prognosis must necessarily remain undetermined. I for one can conceive no difficulty appertaining to the successful treatment of hydrarthrosis, for the disease is mostly of a local character, its seat admits of easy access, and the remedies appropriate to the tenacity of the complaint. Failures frequently recorded must be collectively ascribed to the confusion existing as to the character of the disease, and furthermore to the indiscriminate and empirical application of remedies suggested at random.

The treatment of hydrarthrosis of the knee-joint is exceedingly simple, and resolves itself into two indications:

1. The removal of the serum, and

2. The re-establishment of the proper organization and function of the synovial sac.

To attain the objects in view, internal and external remedies have been commended. Among the former, Gemelle's treatment, with large doses of antimoni, potassio-tartras, was the most prominent, and he reported

to the Academy of Medicine of Paris, in 1840, 28 cases treated successfully. Bonnet, however, thinks, and I fully join in his opinion, that the cases of Gemelle were of recent date, and consisted of those ephemerous rheumatic collections which are exceedingly frequent in some marshy regions of France, and which disappear spontaneously, with very few exceptions. The local remedies having been suggested to meet the first indication are numerous; among them are the contentive bandage, compression with roller or plaster straps, blistering, (Velpeau,) the application of ointments, with quicksilver, iodine or antimonium preparations with camphor, &c., cold douche, and in fine, actual and potential cauterization. The application of hot iron has been particularly recommended by Prof. Bonnet, and highly lauded for its efficacy; yet he has of late preferred injections, evincing thus conclusively that his confidence in hot iron has been sadly shaken. In the course of my surgical career I have met with fair chances to put the remedies just enumerated to a fair test, yet the results attained by them, either singly or collectively, did not come up to the mark of satisfaction, and for obvious reasons; for their modus operandi conjointly presupposes the synovial membrane being in a fit condition for absorption, which I think does not exist. As the results of those remedies depend on mere chances, and admit of no rational calculations, I have of late dispensed with them all, and have been more successful for it.

The direct removal of the serum from the articular cavity may be accomplished in various ways, namely, by free and subcutaneous incisions, and by puncture of the synovial sac. Boyer was the first surgeon who freely entered the joint with his knife, in order to remove the articular serum, and to close up the whole source of secretion by suppuration. He treated in this way four cases, of which three recovered, retaining in part the mobility of the operated joint; in the 4th case the suppuration was so violent as to demand amputation.

Boyer's proceeding has been unfairly adjudicated and unjustly discredited as hazardous and daring, chiefly on the ground that the exposure of articular cavities to the atmospheric air invariably gives rise to most dangerous and violent reaction, periling either limb or life. However well this argument holds with reference to healthy joints, it is entirely inapplicable to affected ones. Numerous observations on record tend to show that the morbid process materially diminishes the susceptibilities of synovial or serous membranes for air or injuries, and that in many instances their exposure to atmospheric air may take

place with impunity, without any reaction whatsoever. Thus I remember, for instance, an operation for ovarian cyst, at the St. Mary's Hospital, London, which lasted about 45 minutes, during which time the entire abdominal cavity was exposed to a cool atmosphere. The patient in question died, if I remember correctly, on the 35th day after the operation, of interual hæmorrhage, whilst no evidence of inflammation could be established. This and similar cases sufficiently prove the fallacy of drawing infereuces from the vital charaeter of synovial membranes in health to that of disease. It is even questionable whether Boyer would have lost his patient by said operation, if his diagnosis had not been erroneous, which I am justified to suspect, judging from his cliuical observations on hydrarthrosis. The free incision is decidedly the most direct remedy for radical eure of hydrarthrosis, fulfilling as it does both indicatious; and this method would still command our consideration, provided we had not come in possession of remedies equally efficacious, preserving at the same time the articular mobility.

Subcutaneous incision of the capsule, for the avowed purpose of relieving joints from their morbid eontents, has been recommended by Goyrand, of Aix, and, cautiously performed, will render good services. But in my opinion it possesses no practical advantage over and above the simple puncture. Both operations are equally useful in relieving the joint from its serous contents; yet, as they can have no possible influence upon the matrix of the serum, being the villi-formed exeresences of the synovial membrane, they are mere palliatives, unless combined with other remedies or proceedings.

For the performance of these operations, the greatest care and precaution has been enjoined by surgical writers, with reference to the hermetical exclusion of atmospheric air, and justly so, for its entrauce into the articular cavity is likely to produce a higher degree of inflammation than intended, and even give rise to suppuration and other troubles connected therewith. But the means recommended by surgical writers are totally inefficient to guard against such an accident. A valvular opening may suffice to exclude air, after terminating the operation, but it can decidedly not do so during the operation, and whilst the canula of the trocar still counects the surface of the body with the artieular cavity.

Nèlaton and other surgeons of note, confess never to have seen the serum rushing from the articular cavity punctured, but issuing slowly and languidly. Such facts render the danger obvious in puncturing joints in the manner hitherto adopted.

In order positively to prevent the entrance of air, it is necessary to make the serum issue from the joint with velocity, and without interruption, until the last drop has been removed. To accomplish this object, the limb should be brought into a straight position previous to the operation, which has the advantage in closing up a part of the articular cavity between femur and tibia, and in forcing the whole contents into the anterior space of the synovial sac. This can be mostly done without any difficulty, in as far as there are but rarely retractions of the flexor muscles, and never articular adhesions. In case, however, an angular contraction of the joint should exist, it should be removed previous to the treatment of hydrarthrosis, either by gradual extension, or, more expeditiously, by tenotomy.

Assuming the extremity is brought to full extension, Theden's bandage should be applied from the toes upwards to a point immediately below the protuberance of the tibia. Next graduated compresses should be placed in the popliteal space, along the ligamentum patellæ, and the latter itself, and they should be firmly fastened by ascending adhesive straps, surrounding the whole joint. This proceeding drives the entire liquid into the cul-de-sac of the synovial membrane, and retains it there under great pressure. If the articular cavity thus prepared is punctured or subcutaneously incised, its contents will escape with such vehemence as to render the entrance of air positively impossible. Whilst the liquid is thus escaping from the joint a finger should move across the cul-de-sac towards the wound, in order to close it in the very moment that the liquid stops to flow, whilst the other hand removes the canula. Such is the mode of preparing the joint I have adopted in my cases, and I can state here, that I not only facilitated the operation thereby, but rendered the latter perfectly harmless, at least in so far as the entrance of atmospheric air is concerned.

It has been already remarked that simple puncture or simple subcutaneous incision act but as palliatives in removing the articular serum for the time being. As in hydrocele, the serum soon reaccumulates, unless other measures are resorted to, calculated to prevent relapse. Thus Larey applied moxæ after puncture, and asserts the cure of an enormous serous collection of the knee-joint by anchylosis, (?) whereas Carrier, in Lyons, effectually combined compression with it. In what manner Carrier compresses the joint I do not know, nor am I at all conversant with Malgaigne's proceedings, who, it seems, adopted Carrier's plan, without meeting, however, with the same satisfactory results; yet that I do know, that by the compression of the joint executed in

the manner described by means of graduated compresses, circular adhesive straps, and subsequent placing of the effected limb in a straight splint, I have succeeded in radically curing thirteen cases of hydrarthrosis of the knee-joint. In ten cases I punctured but once, in two twice, and in one three times. In the latter three cases I contented myself with the compression only, without confining the limb to the straight splint, and perhaps this was the cause of the recidives.

In every instance the mobility of the joint has been preserved, and the results have been thus complete, however unsatisfactory they may have been in the hands of other surgeons. Whether the cases under my care have been particularly advantageous, or the mode of compression I adopted has influenced the results, I am not prepared to decide as yet, but rather reserve my decision for a larger scope of observation. At any rate, the treatment of hydrarthrosis by puncture and compression combinedly, commends itself to the consideration of surgeons.

Since the last ten years another proceeding has been introduced for the treatment of hydrarthrosis. The analogy of hydrocele with hydrarthrosis has induced Bonnet and Velpeau to try the efficacy of stimulating injections in the latter, particularly with tincture of iodine, and the results thus accomplished seem to surpass the most sanguine expectation. They maintain that these injections may be practiced with impunity, without danger or fear of excessive reaction; that in no instance suppuration ensued, and that in most the mobility of the joint was preserved. Other surgeons equally creditable have not met with the same complete results; Nèlaton and others have related some instances of most violent reaction and suppuration after the injection with iodine, and in some amputation had to be resorted to. Having had no personal opportunity to observe the therapeutical effects of injections with iodine into joints afflicted with hydrarthrosis, I justly hesitate to offer any opinion on its value, and its preference to other modes of treatment, and more especially to that of compression and free incision; yet I am inclined to look upon compression as both the mildest and least hazardous of the three, and it should therefore be preferred in recent and minor cases. Should it repeatedly fail, injections should be employed, and in very obstinate and inveterate cases I should not hesitate to adopt Boyer's plan of free incision into the joint, and of closing its cavity by suppuration.